

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
21 October 2004 (21.10.2004)

PCT

(10) International Publication Number
WO 2004/089679 A2

- (51) International Patent Classification⁷: **B60L**
- (21) International Application Number:
PCT/GB2004/001594
- (22) International Filing Date: 13 April 2004 (13.04.2004)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
0308330.0 10 April 2003 (10.04.2003) GB
- (71) Applicant (for all designated States except US): **ADVANCED TRANSPORT SYSTEMS LTD** [GB/GB]; Unit 5 Brunel Way, Thornbury, Bristol BS35 3UR (GB).
- (72) Inventors; and
- (75) Inventors/Applicants (for US only): **LOWSON, Martin, V.** [GB/GB]; Alpenfels, North Road, Leigh Woods, Bristol, BS8 3PJ (GB). **COOK, Christopher, V.** [GB/GB]; Stourton House, Shipton-on-Stour, Warkshire CV36 5HG (GB). **HUGHES, David, G., H.** [GB/GB]; 173 Badminton Road, Downend, Bristol BS16 6NW (GB).
- (74) Agent: **CHEYNE, John, Robert, Alexander, Mackenzie;** Haseltine Lake, Imperial House, 15-19 Kingsway, London WC2B 6UD (GB).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

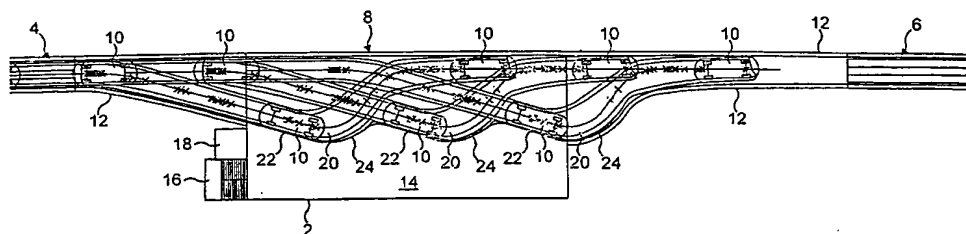
(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— without international search report and to be republished upon receipt of that report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: STATION DESIGN FOR PERSONAL RAPID TRANSPORT SYSTEMS



(57) Abstract: A station (2) in a personal rapid transit system has a platform (14), the edge of which defines bays (20) for parked vehicles (10). The parked vehicles are out of the path of travelling vehicles moving in a transit path extending between an entry section (4) and an exit section (6). The bays (10) include parking sections (22) alongside which the vehicles may park to enable easy transfer of passengers into and out of the vehicles. The disposition of the parking sections (22) allows the steered vehicles (10) to park close to the platform edge. The stations comprise bypass tracks (36) branched off the main track (30) and disposed in various configurations.

WO 2004/089679 A2

This Page Blank (uspto)

STATION DESIGN FOR PERSONAL RAPID TRANSPORT SYSTEMS

This invention relates to the design of stations in a personal rapid transport system.

5

In general, a personal rapid transport (PRT) system comprises a dedicated guideway or track on which individual vehicles travel between stations. Each vehicle contains only one passenger or group of passengers, and the vehicle travels continuously between the starting point and the destination without stopping at any intermediate stations. PRT systems thus provide a compromise between a conventional mass transport system such as buses, trains and metro systems, and individual passenger cars.

15

An example of a PRT system is disclosed in US 4061089. In that system, a station is provided on a bypass guideway branched off the main guideway. Lateral bays or "slots" extend from the bypass guideway. Vehicles enter these slots to drop off or pick up passengers. While in the slots, the vehicles do not obstruct other traffic passing along the bypass guideway. However, manoeuvring the vehicles in to and out of the slots is not straightforward and requires mechanical handling of the vehicles. While this mechanical handling takes place, the vehicle may obstruct other vehicles travelling along the bypass guideway.

30

Another difficulty arising in stations is that steered vehicles require a significant distance in which to move close to a platform edge. Consequently, if a station is designed like a conventional railway station, with a single generally straight platform edge, it will not be possible to park vehicles sufficiently close to the platform to

achieve a sufficiently narrow gap (for example, of less than 50 mm) to avoid the danger of passengers injuring themselves as they move into or out of the vehicle. This is particularly so if other vehicles are already
5 distributed along the platform.

According to the present invention there is provided a station in a personal rapid transit system, the station comprising a guideway portion bounded on at least one side
10 by a platform, the width of the guideway portion being sufficient for travelling vehicles of the system to travel along a transit path in a normal travel direction of the vehicles unobstructed by vehicles parked against the platform, the platform extending generally parallel to the
15 transit path, and comprising a plurality of bays for receiving parked vehicles, each bay being defined by a respective parking section of the platform edge, which parking section extends obliquely to the transit path, whereby a steered vehicle of the system can move from the
20 transit path; while maintaining a forwards travel direction of the vehicle, to park against the section of the platform edge of a respective one of the bays by turning from the transit path through an acute angle.

25 The parking section is preferably straight, and may be inclined to the transit path travel direction by an angle of less than 45 degrees. In a preferred embodiment, this angle is in the range of 10 to 20 degrees.

30 A vehicle entering the station is thus able to turn off the transit path through a relatively small angle and then continue along a substantially straight path to park very close to the parking section, eliminating any substantial gap between the vehicle and the platform.

The bays may be distributed along the platform in a direction parallel to the transit path. The parking sections of adjacent bays may be joined to each other by a transition section which extends from the front end of the parking section of one bay to the rear end of the parking section of the adjacent bay. In this context, "front" and "rear" relate to the normal direction of travel of the vehicles. Thus, in operation, a vehicle entering the bay from the transit path will move parallel to the parking section towards the transition section, and stop with one side of the vehicle adjacent the platform at the parking section.

The transition section may be concavely curved with a radius of curvature greater than the turning circle of the vehicle, so that the vehicle may leave the bay without reversing so as to return to the transit path. Alternatively, the vehicle may perform a relatively short reversing manoeuvre before moving forwards to rejoin the transit path.

The length of the parking sections of the platform edge region is preferably approximately equal to, or perhaps slightly less than, the length of the vehicles of the PRT system.

In a preferred embodiment, the guideway portion, including the transit path, is straight, and the bays are distributed along the platform in a line generally parallel to the guideway portion. The parking sections of the bays are parallel to each other and the perpendicular spacing between them is not less than one vehicle width.

- It is desirable for several reasons for the main track of a PRT system to be elevated above ground level. This minimises obstruction to existing road traffic, but also reduces severance by the main track. That is, elevation of the main track does not provide a barrier to vehicles and pedestrians wishing to cross from one side of the track to the other. Elevating the main track avoids the needs for expensive bridges and underpasses.
- 10 It is not economically practical for vehicles to stop at stations while on the main track. This would obstruct the flow of other vehicles which may not need to stop at the same station. Consequently, it is known to divert vehicles off the main track on to a bypass track which passes
- 15 through the station. Vehicles then leave the main track to pass along the bypass track for loading and unloading at the station. Where the main track is elevated, it is conventional for the bypass tracks passing through stations to be at the same level as the main track. This involves
- 20 considerable capital expense, since the entire station structure needs also to be elevated. Furthermore, measures such as elevators and escalators need to be provided to transport passengers between ground level and the station.
- 25 According to a second aspect of the present invention, there is provided a station in a personal rapid transport system comprising a main track along which vehicles of the system travel between a departure station and a destination station, the station being provided on a bypass track which
- 30 is branched from the main track, the bypass track extending through the station at a level below that of the stretch of the main track which passes the station.

In one embodiment in accordance with this aspect of the present invention, the bypass track departs from, and rejoins, the main track on the same side of the main track, in which case the bypass track, as it extends through the station, is generally parallel to the main track. In an alternative embodiment, the bypass track leaves the main track on one side of the main track and rejoins on the other side. In this embodiment, the station and the bypass track extending through it, are situated beneath the main track.

A platform may be provided on one or both sides of the bypass track as it passes through the station.

According to a third aspect of the present invention, there is provided a personal rapid transit system comprising a main track along which vehicles of the system travel between a departure station and a destination station, the station being provided on bypass tracks which are branched from the main track on opposite sides of the main track, the bypass tracks extending through the station.

A bridge may be provided over the main track, to connect platforms situated beside the bypass tracks. The platforms may, for example, be situated on the sides of the bypass tracks away from the main track.

For a better understanding of the present invention, and to show how it may be carried into effect, reference will now be made, by way of example, to the accompanying drawings, in which:-

Figure 1 shows a guideway portion of a personal rapid transport system;

Figure 2 indicates diagrammatically the travel paths of vehicles entering and leaving the guideway portion shown in Figure 1;

5

Figure 3 shows an alternative vehicle travel path;

Figure 4 shows a schematic station configuration.

10 Figure 5 shows an alternative schematic station configuration;

Figure 6 is a partial view taken generally in the direction of the arrow VI in Figure 5; and

15

Figure 7 shows a third schematic station configuration.

The guideway portion shown in Figure 1 passes through a station represented by a rectangular boundary 2. The
20 guideway portion includes an entrance section 4 and an exit section 6, which comprise parallel-sided track ways. Between the sections 4 and 6 there is an intermediate section 8 which passes through the station 2. Vehicles 10 are represented in Figure 1, with moving vehicles shown in
25 relatively faint outline, and stationary vehicles shown in relatively heavy outline. The vehicles have steered front wheels.

The sections 4 and 6 are single-track guideways bounded by
30 walls 12. On one side of the guideway, the wall 12 continues along the intermediate portion 8, but on the other side the wall 12 terminates at the station 2. Within the station 2 there is a platform 14 which is accessible by passengers by means of stairs 16 and a lift 18.

The edge of the platform bounding the intermediate guideway 8 has a scalloped form defining a plurality of bays 20 (three in the embodiment shown in Figure 1). It will be appreciated that these bays are offset laterally from a notional transit path through the intermediate section 8 in alignment with the sections 4 and 6. Consequently, vehicles 10 parked in the bays 20 will not obstruct vehicles travelling along the transit path to or from one or other of the bays 20.

Each bay 20 is defined by a straight parking section 22 and a transition portion 24 of the edge of the platform 14. The parking sections 22 are parallel to each other and are inclined at an angle of approximately 15° to the direction of the transit path. Each parking section 22 has a length which is approximately equal to that of each vehicle 10, although it will be appreciated that the parking section 22 of the bay 20 nearest to the entry section 4 is extended in order to merge with that section. Thus, as shown in Figure 1, each bay 20 may be occupied by a single vehicle parked side on to the parking section 22, so that side doors of the vehicle open on to the platform 14. The transition section 24 of each bay 20 extends from the front end of the respective parking section 22 to the rear end of the parking section of the next bay 20 to the front, with the exception of the transition portion of the bay 20 nearest to the exit section 6, which merges into that section.

The oblique orientation of the parking sections 22 means that vehicles 10, steered by their front wheels, can move off the transit path into a bay by a simple turn through 15° , ie the angle of inclination of the parking sections 22 relative to the transit path. The vehicle can then proceed

into the bay, stopping with its side not more than 50 mm from the platform edge.

As shown in Figure 1, the transition sections 24 are
5 concave, and curved with a radius somewhat larger than the radius of the minimum turning circle of the vehicles 10. As a result, a vehicle 10 parked in a bay 20 can leave the bay by moving forwards past the transition section 24 to rejoin the transit path. This manoeuvre is represented for
10 the vehicle 10A in Figure 2, the travel path of which is shown for a manoeuvre from the transit path at position 10A' to a bay 20 in position 10A'' and then returning to the transit path at position 10A'''.

15 An alternative manoeuvre is shown in Figure 3, which appropriate if the bays 20 need to be more closely stacked to increase the capacity of the station 2 without extending its length. In the manoeuvre shown in Figure 3, the vehicle 10A is reversed slightly from the parked position
20 before moving forwards to rejoin the transit path, while avoiding a vehicle 10B parked in the adjacent bay 20.

It should be noted that, in Figures 2 and 3, the guideway
25 portion is shown only diagrammatically, without boundary walls such as shown at 12 in Figure 1.

Figures 4 to 6 show different embodiments of a station
which may or may not include the platform arrangement shown
in Figures 1 to 3.

30

With reference to Figure 4, the PRT system comprises a main through track 30 which is elevated above ground level and runs past a station 32. At the station 32, there is a platform 34 disposed beneath the main track 30. Two branch

bypass tracks 36 are branched from the main track 30 and extend past the platform 34 in a direction which is parallel to that of the track 30, with one on each side.

5 In use, passengers may reach the platform 34 from the ends, after passing underneath portions 38 of the bypass tracks shortly after they leave, or rejoin, the elevated main track 30. At these regions, the bypass track 36 is sloping downwards from the main track 30 towards the level of the
10 platform 34, and consequently there is sufficient headroom for the passage of passengers. The portions 38 on the left of the station as seen in Figure 4 are used for deceleration of the vehicles 10 after they have left the main track 30. The portions of the bypass track 38 to the
15 right as seen in Figure 4 are used for acceleration of the vehicles 10 before they rejoin the track 30. Consequently, vehicles travelling along the track 30 past the station may travel at the full normal speed, so minimising congestion on the main track 30..

20

There may be a lift 40 to provide access to the platform 34 to disabled people, or, in some circumstances, where the platform 34 is situated some level above ground level, but nevertheless beneath the main track 30.

25

The platform 34, and the bypass tracks 36, may be constructed in the manner disclosed in Figures 1 to 3. Alternatively, however, each bypass track may comprise a loading bay 42 and one or more waiting bays 44. In use,
30 passengers embark and disembark from vehicles in the loading bay 42. Any empty vehicles waiting for new passengers will stand in the waiting bay 44. Vehicles entering the station with passengers intending to disembark will be diverted to the bypass track having the shortest

wait before reaching the loading bay 42, or alternatively may be permitted to disembark in a waiting bay 44.

The station configuration shown in Figures 5 and 6 also
5 comprises a main track 30 and bypass tracks 36, having
acceleration and deceleration portions 38. In the station
configuration shown in Figures 5 and 6, the main track
extends approximately at ground level (shown in Figure 6 in
a shallow cutting 46). The bypass track 36 is also
10 substantially at ground level. The platforms 34 of the
station shown in Figure 5 are disposed on the side of the
bypass tracks 36 away from the main track 30.
Consequently, passengers arriving at the station to
transfer to a vehicle 30 can approach from either side
15 without needing to cross either the main track 30 or the
bypass tracks 36. However, a bridge 48 may be provided
extending between the platforms 34 and passing over the
main track 30 at a position before (or after) that at which
the bypass tracks 36 branch off (or rejoin) the main track
20 30.

Figure 7 shows a station configuration which is a
modification of that shown in Figure 4 and, again, similar
reference numbers are used to designate similar features.
25

In the configuration of Figure 7, the bypass track 36
leaves the main track 30 on one side, then passes beneath
the main track 30 to rejoin on the other side. Thus, the
station itself is situated directly beneath the main track
30 30 and, again, passengers may move from one side to the
other of both the main track 30 and the bypass track 36 by
passing beneath the deceleration and acceleration portions
38.

CLAIMS

1. A station in a personal rapid transit system, the station comprising a guideway portion bounded on at least one side by a platform, the width of the guideway portion being sufficient for travelling vehicles of the system to travel along a transit path in normal travel direction of the vehicles unobstructed by vehicles parked against the platform, the platform extending generally parallel to the transit path, and comprising a plurality of bays for receiving parked vehicles, each bay being defined by a respective parking section of the platform edge, which parking section extends obliquely to the transit path, whereby a steered vehicle of the system can move from the transit path; while maintaining a forwards travel direction of the vehicle, to park against the section of the platform edge of a respective one of the bays by turning from the transit path through an acute angle.
2. A station as claimed in claim 1, in which the transit path and the bays are provided on a common continuous surface of the guideway portion.
3. A station as claimed in claim 1 or 2, in which the guideway portion of the station comprises a bypass branched from a main guideway of the system.
4. A station as claimed in any one of the preceding claims, in which the parking section of each bay is inclined at an angle of less than 45 degrees to the transit path.

5. A station as claimed in claim 4, in which the angle of inclination of each parking section is not less than 10 degrees and not more than 20 degrees.

5 6. A station as claimed in any one of the preceding claims, in which the parking sections of adjacent bays are connected to each other by a transition section which extends from the front end of one of the parking sections to the rear end of the other.

10

7. A station as claimed in claim 6, in which each transition section is concavely curved with a radius of curvature greater than the radius of the minimum turning circle of vehicles of the system.

15

8. A station as claimed in any one of the preceding claims, in which the parking section of each bay has a length which is able to accommodate no more than one vehicle of the system.

20

9. A station as claimed in any one of the preceding claims, in which the parking sections extend substantially parallel to each other.

25

10. A station as claimed in claim 9, in which the spacing between adjacent parking sections is not less than the width of vehicles of the system.

30

11. A station in a personal rapid transit system comprising a main track along which vehicles of the system travel between a departure station and a destination station, the station being provided on a bypass track which is branched from the main track, the bypass track extending

through the station at a level below that of the stretch of the main track which passes through the station.

12. A station as claimed in claim 11, in which the bypass
5 track leaves the main track to one side of the main track and joins the main track on the other side.

13. A station as claimed in claim 12, in which the station
is situated beneath the main track.

10

14. A station as claimed in any one of claims 11 to 13, in
which a platform is situated adjacent the bypass track on
both sides of the bypass track.

15. A station as claimed in claim 11, in which the bypass
15 track is branched from and rejoins the main track on the
same side of the main track.

16. A station as claimed in claim 15, in which two bypass
20 tracks are provided, one on each side of the main track.

17. A station as claimed in claim 16, in which a platform
is situated between the branch tracks.

18. A station in a personal rapid transit system
25 comprising a main track along which vehicles of the system
travel between a departure station and a destination
station, two bypass tracks being branched from the main
track on opposite sides of the main track, the bypass
30 tracks extending through the station.

19. A station as claimed in claim 18, in which a bridge
extends over the main track to connect platforms disposed
beside the bypass tracks.

20. A station as claimed in claim 19, in which the platforms are disposed on the sides of the bypass tracks situated away from the main track.

5

21. A station as claimed in any one of claims 15 to 20, in which the main track runs past the station in a cutting.

22. A station substantially as described herein with
10 reference to, and as shown in, Figures 1 to 3, or Figure 4, or Figures 5 and 6, or Figure 7 of the accompanying drawings.

1 / 5

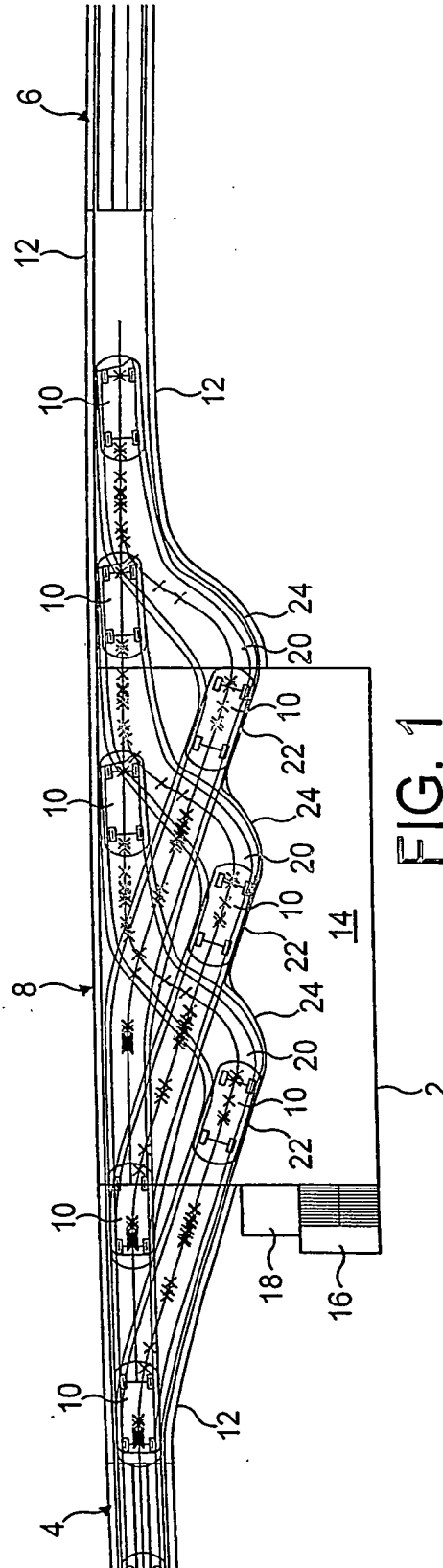


FIG. 1

This Page Blank (Copy)

2 / 5

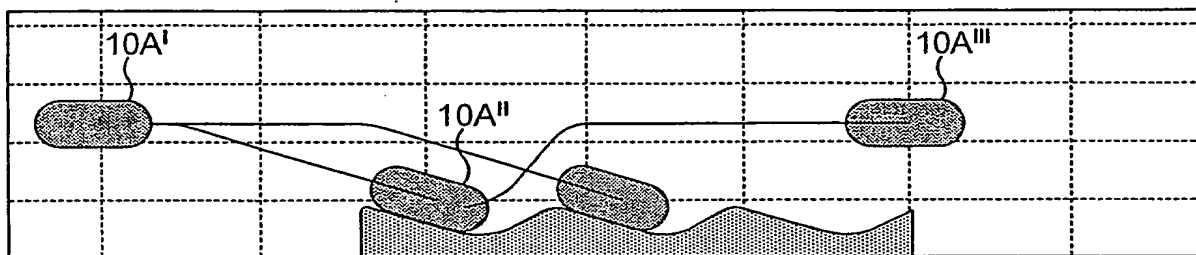


FIG. 2

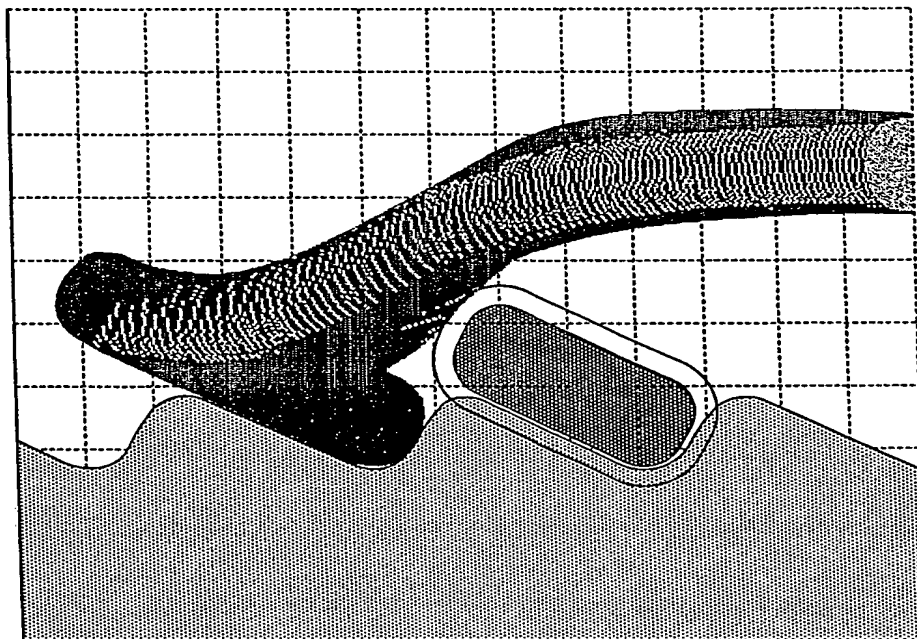
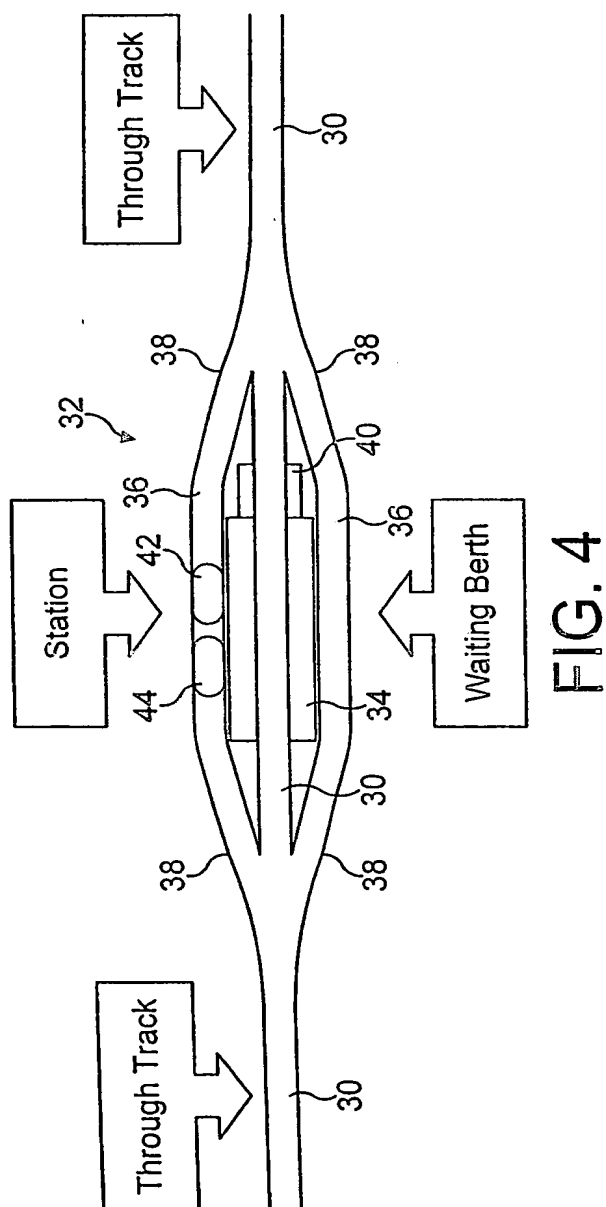


FIG. 3

This Page Blank (uspto)



This Page Blank (usplc)

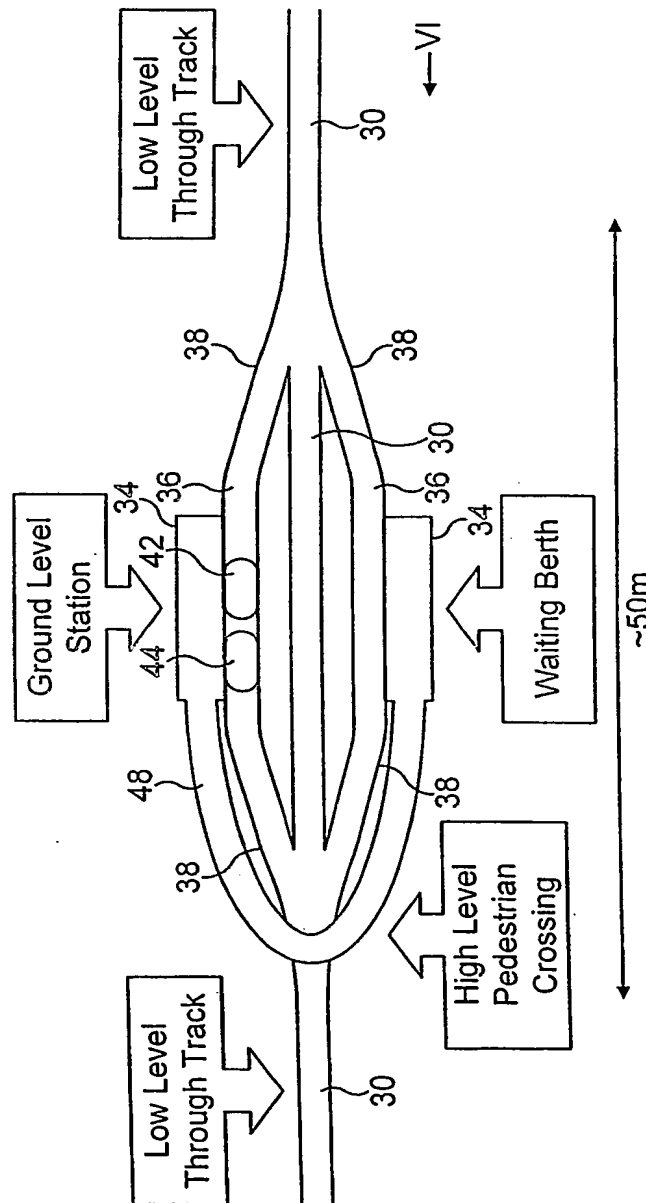
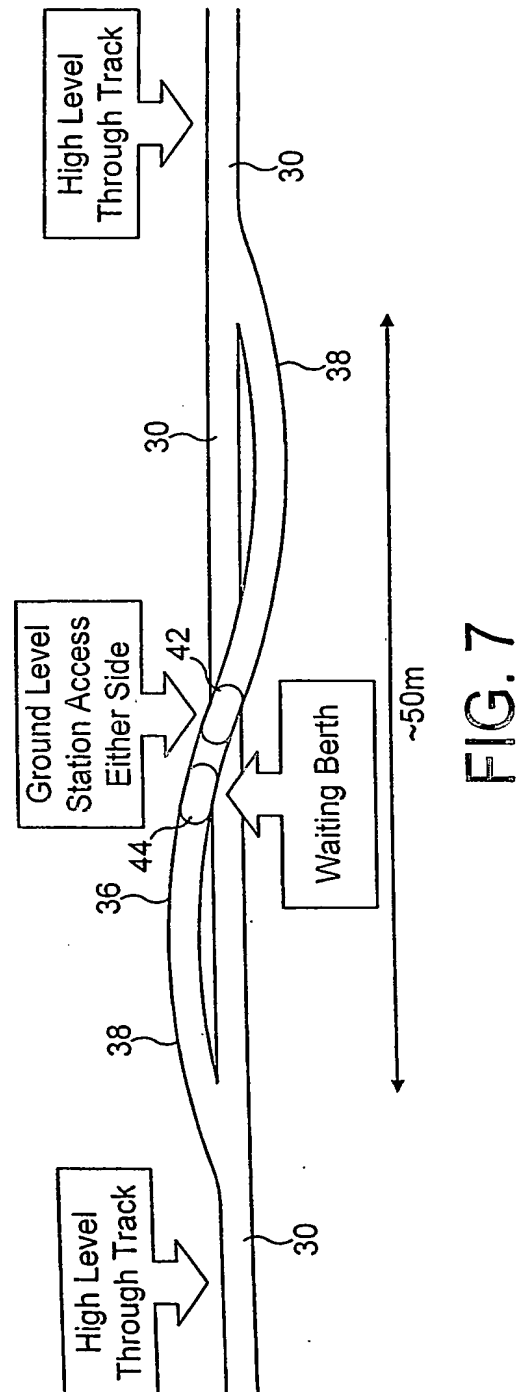
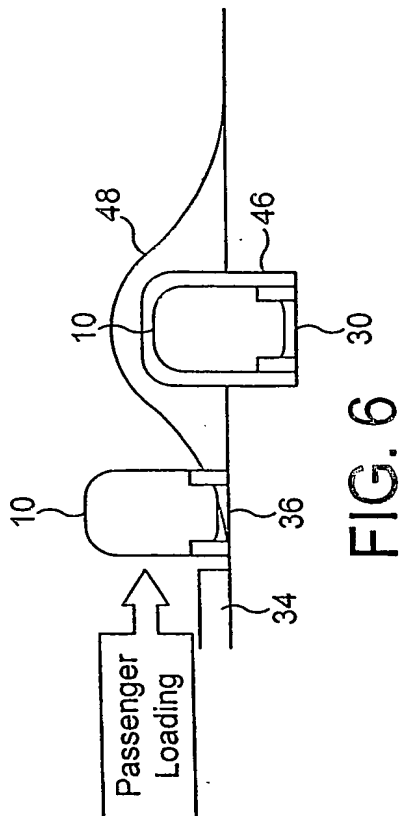


FIG. 5

This Page Blank (uspto)



This Page Blank (uspto)

This Page Blank (uspto)